

KEYS TO PROFITABLE LETTUCE PRODUCTION

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Lettuce acreage in Texas averaged 7,700 acres annually from 1967 to 1969. The average value of the crop for these 3 years was \$6 million. Lettuce accounted for 2.7 percent of the acreage and 4.9 percent of the value of the 1969 Texas vegetable industry.

Areas of Production

Most of the acreage is located in South Texas, including the San Antonio-Winter Garden Area and the Lower Rio Grande Valley. These areas are defined as winter production which totals about 5,200 acres or 67 percent of Texas lettuce. The early fall lettuce is produced in the High Plains and consists of about 2,500 acres or 33 percent.

The three leading counties in acreage for winter-marketed lettuce are Hidalgo, Starr and Zavala, while Deaf Smith and Castro counties lead in lettuce marketed in early fall.

Seasonal Movement

Planting in the High Plains begins the latter part of June and continues into August with most of the acreage seeded in July. Planting in South Texas begins the latter part of August in the Winter Garden Area and continues into October. In the Lower Rio Grande Valley, seeding begins in early September with most of the acreage planted in late September and early October. Crops for late-season harvest are seeded in December and early January.

Limited supplies from the High Plains are available the last half of September, with most active harvest occurring during late September and the first half of October. Movement continues from the High Plains through early November or until harvest is terminated by freezing weather. Harvest begins in mid-November in the Winter Garden Area and the latter part of November in the Rio Grande Valley. The largest part of the crop is harvested from late December through February with late crops in the Winter Garden Area producing through May.

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Figure 1 shows the movement of Texas lettuce to market by months to the 41 major cities in carlot equivalents.

Climatic Requirements

Lettuce is a cool-season crop, preferring mean temperatures between 55 and 60 degrees F during the growing season. Warmer temperatures and longer days accelerate growth. High-quality lettuce is producible only when the air and soil temperatures are moderately cool and uniform while the crop is maturing. High temperatures tend to cause loose heads, bitterness and some diseases. Early in its development, lettuce will tolerate considerable frost, but if severely frosted when nearly mature, it is more subject to slime. Bolting may occur if the lettuce plants are subjected to high temperatures during most of the growing season. The time required from seeding to harvest ranges from 60 to 120 days, depending on variety and climatic conditions.

Soil Types

Lettuce grows successfully on almost any type of soil that is well-drained and fertile. For early crops subject to relatively high temperatures, clay

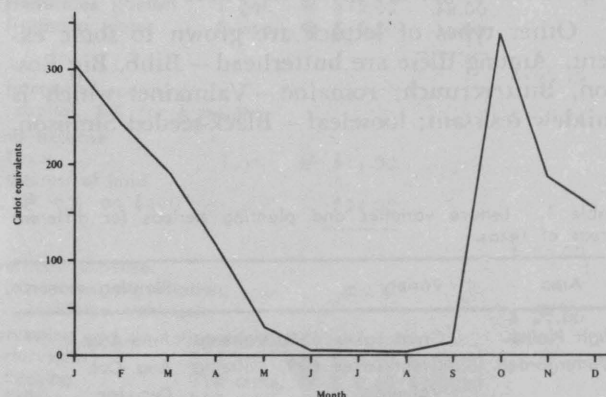


Fig. 1. Seasonal shipment of Texas lettuce as measured by carlot equivalents unloaded in 41 major U. S. cities by months, 1964-69, excluding 1968.

loams or heavy soil types should be used. These soils have a greater water-holding capacity and generally are cooler. For early spring lettuce, use lighter soils that are well drained.

Land Preparation

Prepare the seedbed by plowing, disking and floating the land before listing up the furrows. Tillage should leave the soil mellow, free of large clods and trashy organic matter.

Fertilizing

The lettuce plant is a poor forager for nutrients because of the limited root system. All phosphorous fertilizer should be banded 3 to 4 inches directly below the seed at planting. Apply 60 to 80 pounds of P_2O_5 per acre. Generally, 80 to 100 pounds of N are required to produce a good lettuce crop. Specific fertilizer requirements are based on the individual soil type, season and the previous crops grown on the land.

Varieties

Great Lakes 659, the predominant lettuce variety grown in Texas, is recognized for its ability to produce high yields of uniformly large firm heads under a variety of conditions. It is moderately slow bolting and resistant to tip burn; however, it is not resistant to downy mildew.

Valtemp, Valrio and Valverde were developed for southern Texas where downy mildew is a problem. Valtemp is an early season variety which heads well under warm conditions and is resistant to downy mildew. Valrio is a mid-season variety which heads well under cool conditions and also is resistant to downy mildew. Valverde is noted for its high quality, resistance to downy mildew and adaptability for late winter production. Some lettuce varieties and planting periods for different regions of Texas are given in Table 1.

Other types of lettuce are grown to some extent. Among these are butterhead — Bibb, Big Boston, Buttercrunch; romaine — Valmaine, which is mildew resistant; looseleaf — Black-seeded Simpson.

Table 1. Lettuce varieties and planting periods for different areas of Texas.

Area	Variety	Planting season
High Plains Wintergarden	Great Lakes 659, Valtemp	June-Aug.
	Great Lakes 659, Valtemp	Aug.-Oct.
	Valverde	Dec.-Jan.
Rio Grande Valley	Great Lakes 659, Valtemp	Sept.-early Oct.
	Valrio, Great Lakes 6238	Oct. 15-Nov. 15
	Valverde	Nov. 15-Dec. 15

Planting

Lettuce is commonly grown on 40-inch beds. The seed is usually sown $\frac{1}{8}$ to $\frac{1}{4}$ inch deep in paired rows 14 to 16 inches apart on the bed which is usually 18 to 20 inches wide at the top. Approximately $2\frac{1}{2}$ to $3\frac{1}{2}$ pounds of seed per acre are required for warm season planting, while $1\frac{1}{2}$ to 2 pounds give a satisfactory stand during cooler weather. The seedlings are thinned to stand 9 to 12 inches apart when they reach the two to three true leaf stage. A second thinning is necessary to eliminate doubles.

Weed Control

A preplant application of 4 to 6 pounds per acre of Prefar incorporated 1 inch deep, or 2 to 6 pounds per acre of Vegadex incorporated $\frac{1}{4}$ to $\frac{1}{2}$ inch deep assures early control of weeds. Balan can be incorporated before seeding at $\frac{3}{4}$ to $1\frac{1}{2}$ pounds per acre. Prefar gives better control of pigweed when used as a pre-emerge surface application at 2 to 4 pounds per acre. All of these herbicides should be applied in 30 to 40 gallons of water per acre.

Irrigation

For the initial irrigation, apply enough water to thoroughly wet the bed. Do not permit the surface soil to dry before emergence. Crusting over of the soil surface will result if free water is permitted to cover the top of the seed bed. A consistently high level of soil moisture is required for optimum growth and high quality. Excessive soil moisture can be harmful at two stages in the growth cycle. The first stage is when excess moisture may cause a shallow and limited root system. The second stage is just before maturity when excess moisture may cause a too rapid growth rate with soft or puffy heads resulting.

Disease Control

Lettuce diseases are caused by viruses, fungi, nematodes, bacteria and physiological problems. These diseases can damage lettuce severely in the field or in transit. Their control is necessary to insure a healthy, profitable crop. Among the most common virus diseases, with their vector in parentheses, are mosaic (aphids), aster yellows (leafhoppers), spotted wilt (thrips), and big vein (probably a soil fungus). Virus diseases are best controlled by using clean, certified seed, by eliminating weed hosts around the field, by crop rotation and by controlling insect vectors. Resistant varieties, when available, should be used. The most important fungal diseases are downy mildew, sclerotinia drop, damping-off and occasionally powdery mildew.

Some varieties are resistant to many of these diseases and should always be used. In addition, a preventive fungicide program using maneb, zineb or basic copper sulfate should be practiced. Sclerotinia drop can be controlled by crop rotation, by avoiding overwatering and by fungicide applications (Botran). Damping-off attacks small seedlings; it is best controlled by treating seeds with a fungicide such as Thiram, Captan or Semesan; crop rotation also helps. Powdery mildew is best controlled with applications of sulfur dust.

Nematodes have been found causing damage to lettuce in the Rio Grande Valley. Fields should be fumigated before planting. Tip-burn, a non-parasitic disease caused by bright warm days following cool damp weather, is best avoided by using resistant varieties. Soft rot decay (slime mold) and other transit diseases can be eliminated by careful handling during harvesting and packing and by proper cooling and ventilation of transport cars.

Insect Control

The primary insects damaging lettuce are cabbage loopers, cutworms, aphids, corn earworms, grasshoppers, tobacco budworms, armyworms, crickets and leafhoppers. Leafhoppers, aphids, cutworms, grasshoppers and crickets can be controlled with periodic applications of parathion at 1/2 pound per acre up to 7 days before harvest on head lettuce. Cabbage loopers and budworms can be controlled with *Bacillus thuringiensis* (Thuricide, Biotrol) at the rate specified by the manufacturers' label. *Bacillus thuringiensis* is a slow killer, but the worms stop feeding on contact and are prevented from pupating and webbing cocoons to the leaves. Corn earworms can be controlled with Sevin applied at 1 to 2 pounds per acre. Armyworms and cabbage loopers can be controlled with Lanate at the rate of 0.45 pounds per acre.

Harvesting and Handling

The first harvest usually occurs when at least 25 percent of the heads are firm. When the market is high, it may pay to begin earlier. Damage to wrapper leaves can be reduced to a minimum by harvesting from late morning or when the leaves are less turgid. Firm heads are cut with long knives, trimmed to remove excess wrapper leaves, graded by size and packed in cardboard cartons holding 18, 24 or 30 heads and weighing 35 to 40 pounds. The bottom layer is arranged with butts down and the top layer with butts up.

The cartons are loaded on pallets and hauled to the vacuum cooler. After cooling, cartons are loaded into precooled refrigerated cars or trucks or into refrigerated storage for holding.

High-quality lettuce can be stored 3 to 4 weeks at 32 degrees F. and high humidity if cooled properly right after harvest.

Lettuce also can be hauled directly from the field to local markets when it can be placed directly into refrigerated storage.

Marketing

Lettuce is sold by the carton at prevailing prices and moved to distant markets in refrigerated railroad cars and trucks. A carlot of lettuce usually consists of eight hundred 35-to-40 pound cartons. Maintaining high standards of quality is essential to promote buyer confidence in Texas lettuce. In general, more than 60 per cent of the total f.o.b. cost is made up of harvesting, packing and selling, while less than 40 percent is comprised of production costs including land and overhead.

Cost and Returns

Estimated costs and returns for lettuce from the Rio Grande Valley are given in Table 2. The total costs of producing, harvesting and packing lettuce by the 40-pound carton as influenced by yield

Table 2. Estimated costs and returns per acre of irrigated lettuce from South Texas, 1969.

Item of expense	No. of units & value or cost value per unit	
Production receipts:	312 crtns. @ \$ 2.36	\$736.32
Cash expense:		
Tractor equipment	15 hr. @ \$ 0.80	\$12.00
Tractor labor	17 hr. @ \$ 1.50	25.50
Other labor (thinning, irrigation)	55 hr. @ \$ 1.40	77.00
Seed	2 lb. @ \$ 4.00	8.00
Fertilizer (60-100-0)	160 lb. @ \$ 0.10	16.00
Insecticides	12 app. @ \$ 2.25	27.00
Fungicides	4 app. @ \$ 4.00	16.00
Herbicides (Prefar)	1 gal. @ \$12.00	12.00
Irrigation water	5 app. @ \$ 3.00	15.00
		\$208.50
Interest of operating capital, 8% for 6 months		\$ 8.34
Land expense:		
Taxes	1 yr. @ \$11.00	
Interest of land @ 6% on \$400		\$24.00
		\$ 35.00
Overhead expense: (equipment depreciation, buildings, vehicles)		\$ 25.00
Harvesting and marketing expense:		
Harvesting	312 crtns. @ \$ 0.50	\$156.00
Packing	312 crtns. @ \$ 0.60	\$187.20
Selling	312 crtns. @ \$ 0.24	\$ 74.88
		\$ 1.34
Total expenses		\$694.32
Return to management		\$ 41.80

Table 3. Cost of producing and marketing Texas winter lettuce as influenced by marketable yield per acre.

Marketable cartons/acre	Cost per carton 24's		
	Production costs*	Harvesting, packing, selling costs*	Total f.o.b. cost
200	\$1.08	\$1.20	\$2.28
300	0.72	1.20	1.92
400	0.54	1.20	1.74
500	0.43	1.20	1.63
600	0.36	1.20	1.56
700	0.31	1.20	1.51
800	0.27	1.20	1.47

*Based on cost estimates in Table 1.

per acre are given in Table 3. Cash expenses, land and overhead costs remain relatively stable. However, harvesting and marketing costs vary directly with yield. The production cost per carton decreases with increasing yields, while harvesting and marketing costs remain the same.

Figure 2 shows the f.o.b. price per carton necessary to break even at various yields. For example, a yield of 600 cartons per acre, as shown in figure 2, requires an f.o.b. price of \$1.56 per carton to break even. But, a lower yield of 400 cartons per acre requires a price of \$1.74 per carton to break even. The curve in figure 2 can be used by individuals to estimate potential return on expected yield or price.

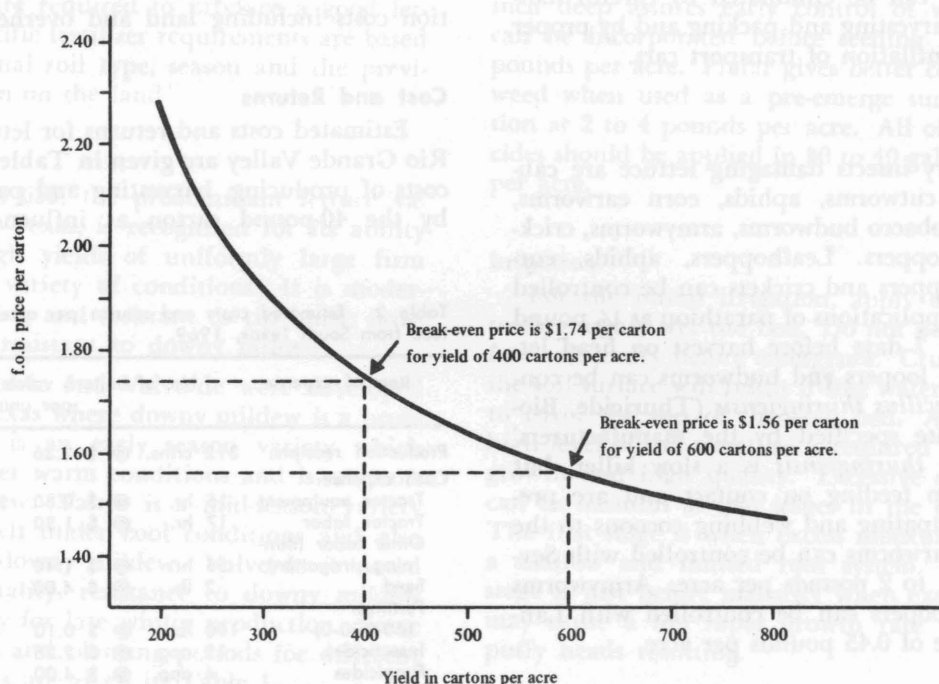


Fig. 2. Price per carton, f.o.b., of Texas lettuce required to break even for different yields. Based on figures in Table 1.

The authors acknowledge the contributions to this publication by Jose Amador, Extension area plant pathologist, and Kenneth Stewart, Extension fruit and vegetable marketing specialist, Weslaco.